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HRE-82

Upshot-Downhole
UPSHOT-DOWNHOLE

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- (4) Personnel shelters of both the corrugated iron and precast concrete types; with and without earth covers.
- (5) Buried structures designed to determine basic data relative to load transmission through earth cover.
- (6) Buried structures designed to determine the effects of various entryways and vents upon the configuration of the blast wave.
- (7) Protection of a load bearing brick wall structure with precast concrete panels.
- (8) Typical precast concrete and light steel frame warehouse strengthened to be blast resistant.
- (9) Test of various types of glazing and window construction.
- (10) Forest Stands.

The projects to test military field installations and equipment included:

- (1) Various especially designed field fortifications, including foxholes instrumented for blast and reflected thermal energy.
- (2) A minefield containing both live and indicator mines for minefield clearance studies.
- (3) Bailey Bridges.
- (4) Railroad rolling stock, military vehicles, Marine Corps LVT's and ordnance equipment in tests designed for statistical analysis of effects.
- (5) Tactical communications systems.
- (6) POL installations.
- (7) Field medical installations.

Instrumentation of structures was accomplished by the Ballistics Research Laboratories, Naval Ordnance Laboratory, and the Stanford Research Institute. Together they operated 670 channels of instrumentation on Shot 9 and 510 on Shot 10.

2.2.4 Program 4 - Bio-medical Effects

This program consisted of five projects covering a diverse group of bio-medical effects of nuclear weapons.

Briefly the operations of this program involved the follow:

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(1) Flying of animals (two monkeys and 60 mice confined in the pressurized cockpit of each of two G-80 drone aircraft) through the cloud of an atomic detonation to determine the relative hazard from inhaled fission products and integrated external gamma radiation.

(2) Exposure of instrumented phantoms simulating a clothed man to the residual radiation of a contaminated ground surface to determine the relative hazard from beta and gamma radiation.

(3) Exposure of statistical numbers of mice to the neutron field emanating from the gun type weapon detonated on this series to evaluate their biological significance.

(4) Subjecting 12 human volunteers and 700 rabbits to the initial light flash from six atomic detonations to investigate its effect on the visual function of human eyes and to determine the burn injury processes in the dark adapted rabbit eye.

(5) Subjecting 56 dogs and 900 rats to the blast wave from two atomic detonations (Shots 9 and 10) to study direct air blast injury in the pressure range of 20 to 50 psi.

2.2.5 Program 5 - Aircraft Structures Tests

This program studied the blast and thermal effects on aircraft in flight. Navy drones were exposed to relatively severe effects where safety requirements would not permit manned aircraft. The Air Force flew manned bombardment-type aircraft in a region expected to produce useful information but without extensive damage to the aircraft.

The Navy AD-2 type drone aircraft participated in five detonations, two manned and three drone flights. The AD-2, in drone operation, was destroyed by severe thermal and blast effects on Shot 7 and the standby XBTD-1 drone substituted for Shots 8 and 9. The conditions obtained by the test aircraft will permit a successful evaluation of thermal and blast effects on AD-type aircraft following delivery of an atomic weapon.

Three instrumented and manned B-50D aircraft in a flight pattern simulating that of a bomb dropping aircraft participated in Shots 4 and 9. Attainment of approximately 75 per cent horizontal stabilizer design limit load on Shot 9 provided sufficiently precise structural data to enable accurate definition of minimum operational parameters for atomic weapon delivery by B-50 aircraft.

In Shot 9 a B-36 aircraft was positioned to obtain a predicted 100 per cent design limit tail load in the up direction. Preliminary indications are that less than expected loads were obtained, however, data collected were sufficient to permit the correlation, verification and/or revision of the present blast load theory.

2.2.6 Program 6 - Tests of Service Equipment and Operations

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and supply personnel and the Rad-Safe Officer, bringing the total strength to 22 men. The main body of the Support Unit arrived on 1 March and brought the over-all strength to 180 men. The arrival of augmentation personnel, Air Force, Navy, and Public Health Service, between 1 March and 17 March, brought the unit to its maximum strength.

Rotation and separation of personnel resulted in constant fluctuation of the unit's strength throughout the test period. However, the unit strength steadily decreased after the ninth shot as personnel who had received their total permissible radiation dosage were returned to their home stations. By 15 June the return of personnel had been completed with the exception of the three officers and the 20 enlisted men who were to remain during the interim period.

5.4 AIR SUPPORT

Air support for the Rad-Safe Unit was provided by AFSWC. The aircraft consisted of two B-29s and one B-25 for cloud tracking, one C-47 and two L-20s for the low level terrain survey, and one helicopter for on-site surveys.

5.5 SUPPLY

All supplies needed for the operation that were not already on hand from previous operations were furnished by the AEC. Shortages in critical items that did not arrive prior to the first shot were borrowed from the Evans Signal Laboratory. The 35,000 film badges for the operation were purchased from DuPont.

5.6 OPERATIONS

Prior to the operational phase an Operation Order assigning the responsibilities and outlining the detailed functioning of the sections of the unit was published in draft form. Functioning of the organization was checked in numerous dry runs during the period 1 to 16 March. The unit was operationally ready for the first shot. The order was published in final form after the start of the test series.

Program and project requirements were met by appointing an officer monitor for each program who coordinated the program's radiological safety requirements during the test series, assisted in preparation of the Schedule of Events for the Test Director's Operation Order and attended all rehearsals of the program personnel prior to each test.

The operational peculiarities for each shot; data including on-site, off-site, air participation; and logistics are included in detail in the draft Radiological Safety Report submitted to the Test Director at the completion of the operation.

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Prior to each shot weather conferences were called by the Test Manager to discuss forecast conditions for the shot. One consideration presented was the direction and intensity of radioactive fall-out. Fall-out was expressed in terms of an infinite dose, the total integrated outside activity over an infinite period of time based on the $t^{-1.2}$ decay law. This predicted infinite dose became a primary consideration of the Test Manager's Advisory Panel during the latter part of the series as the predicted direction of fall-out was generally in an easterly direction and dosage is cumulative. The reader is cautioned that the infinite dose is the maximum dosage a person in the community could receive if he stayed outside in the area of fall-out for an infinite period of time and there were no decrease in activity due to dispersion by winds and rain. Experience indicates that there is a decrease in activity due to dispersion by weather, and that activity inside buildings is generally $1/2$ to $1/3$ of the outside activity. Thus the infinite dose figures in this report are relative only and it is not considered possible that any persons could receive the total computed dosage.

The UPSHOT-KNOTHOLE series of atomic tests presented radiological safety problems which varied from almost nothing for the high air burst, to the greatest problems ever presented at continental tests for the larger tower shots. Shot 7 is an example of the radiological problem produced by a high yield tower shot. The infinite gamma dose for this shot at 200 miles distance from ground zero was 5 roentgens. Moving vehicles as far east as Glendale and Mesquite, Nevada, were found to be contaminated in a few cases to a radiation intensity as high as 500mr/hr. This required the establishment of roadblocks and decontamination stations in these areas to monitor and decontaminate vehicles and personnel. This particular shot differed from some of the other larger tower shots in that it not only presented a large heavily contaminated area across the test site, across the approach routes of recovery personnel, and heavy off-site contamination, but it also presented an unusual dosage ratio when the pocket dosimeter and film badges readings were compared. Film badge readings were approximately twice as high as dosimeter readings and dosages computed by survey meters. Since test personnel and monitors relied on the dosage indicated by their pocket dosimeter and survey meters, 39 personnel received an exposure in excess of the 3.9 r limit established by the Test Manager.

Shot 8 presented a considerable off-site problem. Fall-out occurred over a wide section with the highest levels being recorded on U.S. Highway 93, between Alamo, Nevada, Glendale Junction, Nevada, and St. George, Hurricane, and Kanab, Utah. For this shot the 1 r infinity isodose line extended as far as 250 miles from ground zero and was more than 50 miles wide. Personnel in St. George were requested to take cover at 0925, four hours and 20 minutes after shot time. Many complaints were received from people in the fall-out area. Complaints ranged from goats turning blue to miners suffering radiation sickness.

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Investigations were made of all these claims by members of the Off-Site Rad-Safe Section and by members of the Test Manager's staff. However, none were of a nature to indicate that they were caused directly by radiation from fall-out.

Lincoln Mine was in the area of heavy fall-out on Shot 2. Off-site monitors requested the inhabitants there to remain inside during the morning of the shot. Fall-out was first detected at Lincoln Mine at 0650 with a reading of 3mr/hr. At 0707 a peak reading of 580mr/hr was recorded. The total outside infinite dose was 3.4 r.

As a point of interest the total infinite dose received by the inhabited areas is shown in Table 5.1, and Table 5.2 indicates the work load of on-site operations and the logistics section.

5.7 NEW YORK OPERATIONS OFFICE

The New York Operations Office of the AEC was responsible for monitoring fall-out within the area from 200 to 500 miles radius of the test site. A military liaison officer and a detachment of 16 airmen from Lowry AFB were arranged for by DWET to assist the AEC in this mission. This unit was stationed at Hill AFB.

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CHAPTER 12

TROOP PARTICIPATION

12.1 INTRODUCTION

The Deputy for Military Operations was charged by the Test Manager with the responsibility for the coordination of all troop participation activities. To assist in the discharge of this responsibility Maj John B. Connelly, USA, was appointed in a full-time capacity as the Liaison Officer for Troop Participation.

By agreement between the DOD and the AEC the DOD assumed, for the first time in a Desert Rock exercise, full responsibility for the safety of troops and troop observers. The safety criteria established was 5 psi of overpressure; 6 r in any one series, of which no more than 3 r was prompt, whole body radiation (a maximum of 6 r in any six month period); and 1 cal/sq cm of thermal radiation.

In view of the safety criteria established and the freedom of movement granted Camp Desert Rock personnel within the maneuvering area, the Deputy for Military Operations provided the Test Manager with a troop participation summary on each shot to include the number of participating troops and observers, the number of volunteers, the location of troop and volunteer entrenchment areas with respect to ground zero, the scheme of maneuver, and the expected troop exposure.

12.2 SHOT PARTICIPATION

See Table 12.1 for a tabulation of troop and troop observer participation. Field Command, AFSWP, troop observer participation is included by Service in the tabulation with 24 observers on Shot 1, 49 on Shot 2, 50 on Shot 7, 119 on Shot 8, 64 on Shot 9, and 17 on Shot 10 for a total of 323 observers.

Each troop maneuver included the use of two Battalion Combat Teams (BCTs) which advanced toward objectives in the vicinity of ground zero, the first 1500 yds of advance being tactical movement by squad rushes and the remainder of the advance by march firing. After reaching the objective the troops joined the troop observers in an administrative walk through the Desert Rock display area for indoctrinational purposes. The display area contained military equipment, standard field fortifications, and a number of sheep for each shot in which troops participated except Shot 1. Located at positions both above and below the ground at distances from ground zero to 3500 yds were such items as an M3A4 tank, a 105 howitzer gun, a 90-mm AA Gun, a 57-mm gun, trucks ($\frac{1}{2}$ and $2\frac{1}{2}$ ton),

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rocket launchers, light and heavy machine guns, 60-mm and 80-mm mortars, a 57-mm recoilless rifle, a flame thrower, a SCR-300 radio, a shelter tent, and sheep. The equipment and animal displays were observed both on a pre-shot and post-shot tour of the display area. Furthermore, each shot of the series in which troops participated was considered to simulate an actual atomic weapon employed to facilitate troop advance. Ground zero was assumed to be 1500 yds in rear of the aggressor lines. Friendly troops were positioned in prepared trenches at 3500, 4000, 5000 and 9800 yds for various shots depending on the size and the type of delivery.

The maneuver conducted on Shot 2 is considered typical and is described in detail herein (see Fig. 12.1). For this maneuver a complete rehearsal was conducted on 22 March. The full-scale maneuver followed the detonation in Area T-4 at 0510 PST on 24 March. Participating troops included 2349 troops from the Second, Third, Fifth, and Sixth Army Areas and 515 troop observers representing all the Services. Soon after the detonation the wind increased from 2 to 4 knots/hr and then to 6 knots/hr from the north. By direction of the Test Manager, information of this increase in wind velocity was passed to the Exercise Director. Despite the increase in wind and the great amount of dust present, the troops attacked at 0533 PST toward the objectives 4000 yds to the north and the troops were able to advance to within 500 yds of ground zero. At 0631 PST the observer group departed the trenches to join the troops in a tour of the equipment and animal display. Two Army H-23 helicopters were also used for Desert Rock Rad-Safe reconnaissance and evacuation standby. All troops left the forward area at 0800 PST for the return to Camp Desert Rock. The average troop participant received approximately 2.5 r.

A Marine Helicopter Detachment with four HRS-2 type aircraft also participated in Shot 2, the first of eight similar operational exercises directed by the Commandant of the Marine Corps to: (a) develop and recommend tactics and techniques for the employment of helicopters in conjunction with atomic fire support; and (b) further the study of the limitations imposed by dust and residual radiation. Essentially all such maneuvers consisted of the placement of the aircraft (either on the ground or in the air) in an area to receive not greater than $\frac{1}{2}$ psi overpressure followed by an immediate advance to the vicinity of ground zero or to the edge of the dust cloud. This detachment did not operate on Shots 1, 10 and 11.

The remaining shots of Exercise Desert Rock V proceeded generally as scheduled. Because of AFSWC and Office Chief Army Field Forces (OCAFF) safety restrictions, the troop and troop observers were entrenched 9800 yds southwest of ground zero for Shot 9. In Shot 4, an air drop, only a limited number of observers participated; there was no troop maneuver involved. For Shot 10, utilizing the 280-mm gun, the troops were likewise limited in location and maneuvering. The entrenchment area was located 5000 yds east of ground zero with part of the maneuvering area cutting through the military effects tests area. In Shot 5,

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primarily a Marine participating shot, the two Marine BGTs simulated a beachhead assault. A feature of this maneuver was the use of 39 helicopters (HRS-2 type) which airlifted one company of Marines to an objective west of ground zero.

12.3 OFFICER VOLUNTEER PROGRAM

In compliance with CMAFF directives the Exercise Director, Camp Desert Rock, conducted an Officer Volunteer Program in conjunction with the general troop participation. In this program selected officer volunteers, trained in calculating the effects of atomic weapons, were positioned in trenches at 2500 and 2000 yds from ground zero on Shots 2, 5 and 7 (see Fig. 12.1). The location of the trench in each case was based on the determination of the safe distance by the participating volunteers. This distance was calculated using data in TM 23-200, Capabilities of Atomic Weapons, dated 1 October 1952. Criteria for the program was 8 psi overpressure; 10 r in any one test of which no more than 5 r was prompt whole body radiation and with the further limitation that no volunteer would take more than 25 r in this series of tests; and 1 cal/sq cm of thermal radiation. The average radiation received by the nine volunteers on Shot 2 was 0.5 r; the 12 volunteers on Shot 5, 6.1 r; and the eight volunteers on Shot 7, 13.6 r. Only one officer volunteer participated in more than one of the three shots and he received a total radiation dosage of 26.6 r.